



**Using Pavement Management
Software to Optimize Your Pavement
Preservation Program –
The Montgomery County**

Introduction by:

Randy Paugh, Pavement Management Engineer,
Montgomery County Division of Highway Services

Presented by:

Alan Kercher P.E., President, Kercher Engineering, Inc.



Topics to be Covered

- Overview of Comprehensive Pavement Management
- What Functionality Should a County's PMS Software Have?
 - Montgomery County Story



Comprehensive Pavement Management

- More than just Software
- Cradle to Grave Approach
 - Project-specific Designs
 - Utilizing the Toolbox
 - Project-specific Contract Documents
 - Thorough Inspection
- Land Development
 - Ensuring Durability of New Infrastructure
- Utilities



Utilize the Entire Tool Box



Should Have Been CIR



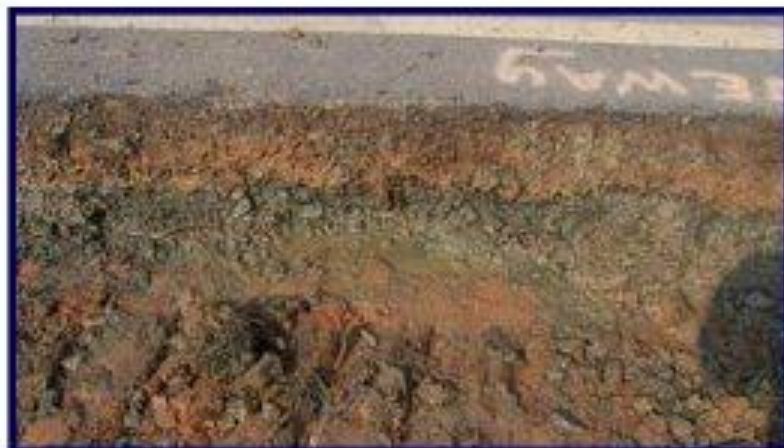
Should Have Been FDR





Design and Build it Correctly

4 Projects - All <6-Months Old





Destroyed by Utility Cuts





Utility Cuts - Planned Destruction





**Pavement Management
Software to Optimize Your
Pavement Preservation
Program**

**The
Montgomery County
Story**



Montgomery County Pavement Management System

- 24,000 Segments
- Management Setup
 - Compatible to County Practices
- Created Street Inventory File
 - Data Compatible with County's GIS Data
- Initial Road Rating Data Completed
 - June 2008 to August 2008



Goals

- Network Level Planning Tool
 - Predicting the Future
 - Rigorous Budget Analysis
- Project Level Tools
 - Historical Database
 - Design Tool
- Automating Project List Process
 - Neighborhoods
- Integration with other Departments/Agencies



Pavement Management Software

- Budget Analysis Tool
- Project Level Design Tool
- Research Tool



Network Level

- Budget Analysis - What if scenarios
 - Status Quo
 - Increase Budget
 - Decrease Budget
- Repair Strategies
 - Optimized vs. Worst First
 - CIR vs. Remove and Replace
- Goal Setting



Configuration

- Unique Pavement Types
 - Thick Pavements vs. Thin Pavements
 - High Traffic vs. Low Traffic
 - GABC Base vs. Recycled Base
 - Hot Mix w/ Micro-Surfacing vs. No Micro-surfacing
- Different Treatments by Classification, etc.
 - Multiple Decision Trees
- Unique Performance Models



Integration with Asset Management:

- Sidewalks
 - ADA, Walkable Communities, Safe Routes to School, etc.
- Safety Improvements
 - Realignments, Intersections, Friction, etc.
- Drainage/Utilities
 - Cut Policies, Coordinate Activities, etc.
 - WSSC



GIS Map - Waterline Project Conflicts

GIS Reports (6_report_build_gis) / Montgomery County / AARON - Windows Internet Explorer

Http://localhost/pms_city/Kernel/main.jsp

File Edit View Favorites Tools Help

GIS Reports (6_report_build_gis) / Montgomery Coun...

AgileAssets Management System V 5.0 (build 3401)

PMS System

Utilities Setup Database Network Analysis Reports

Selection Setup Report

Repair Description

1 pages (3 rows)

Color	ITEM DESCR
Red	Rehabilitation
Blue	Waterline Replacement
Green	Renab-Waterline

Waterline Project Conflict Map

Design Mode

AgileAssets

start GIS Reports (6_report... Microsoft PowerPoint... Internet 100% 1:50 PM



GIS Map - Waterline Project Conflicts

Pop Window

AgileAssets Management System V 5.0 (build 3401)

Waterline Project Conflict Map

GIS Report Data (gls_report_data)

Street Name	WOODLAND DR-00	Performance Model Type	Initial Construction
From Street	COLUMBIA BLV	Council District	5
To Street	WHITE OAK DR		
Length	0.107		
Width	20		
Wearing Course	Flexible		
Classification	Neighborhood		
Maintenance District	Silver Spring		
RSC	Silver Spring		
Traffic Range	Medium		
Permit Age	17		
Year	2008		
Value	1800		
PCI	45.0		
Repair Description	Waterline Replacement		
Cost	46075.00		
Comments			
Alt.			
Last Updated on	1/29/2009		



Montgomery County Pavement Management System

- Implementation Started - May 2009
 - Management Setup
 - Optimization Analyses, Multi-year Funding Reports and Backlog (Benefit) Reports
 - Completed August 2009



Backlog Analysis

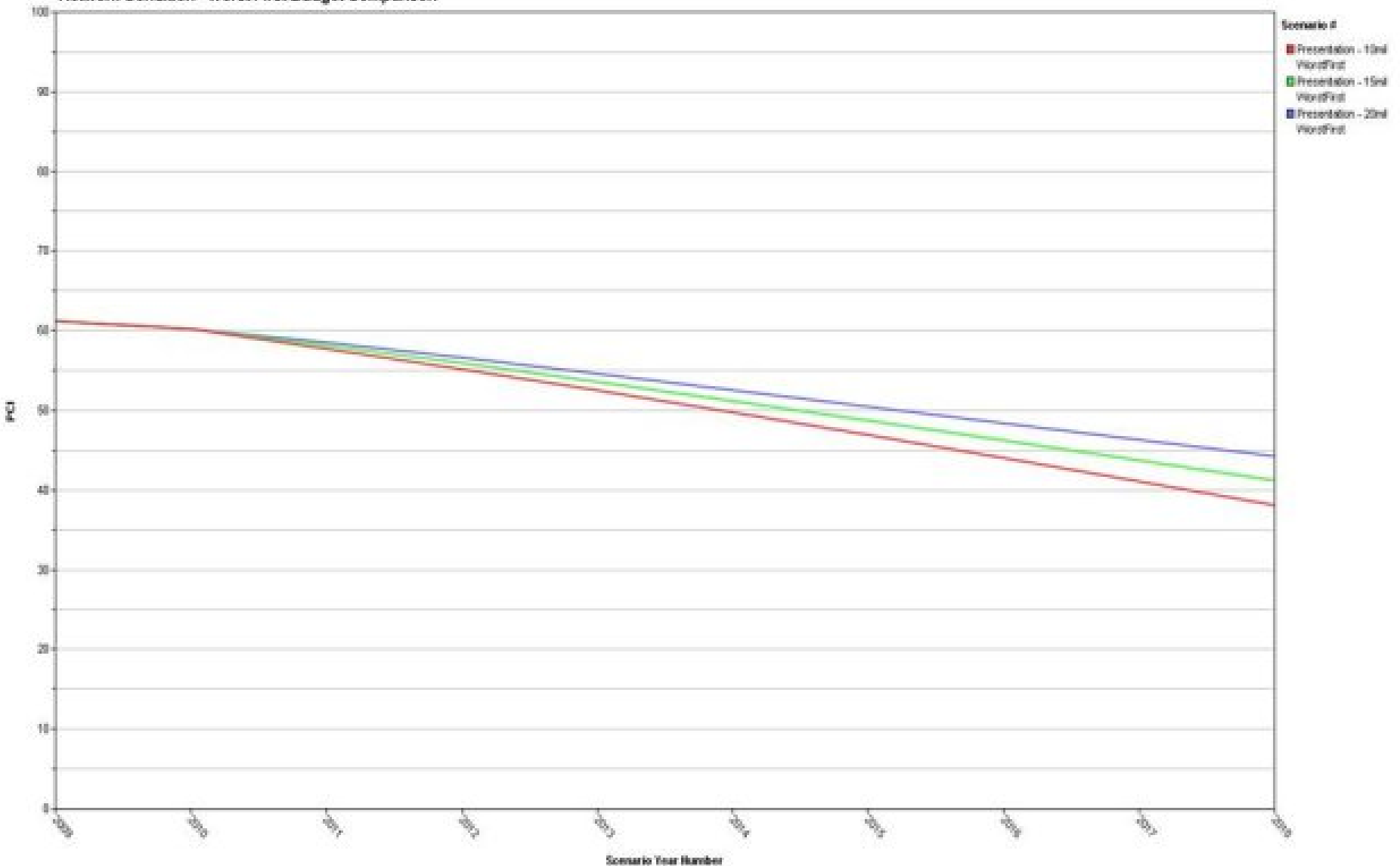
aka “Monetary Impact” of Deterioration

Benefits of Optimization

“Sustainability”

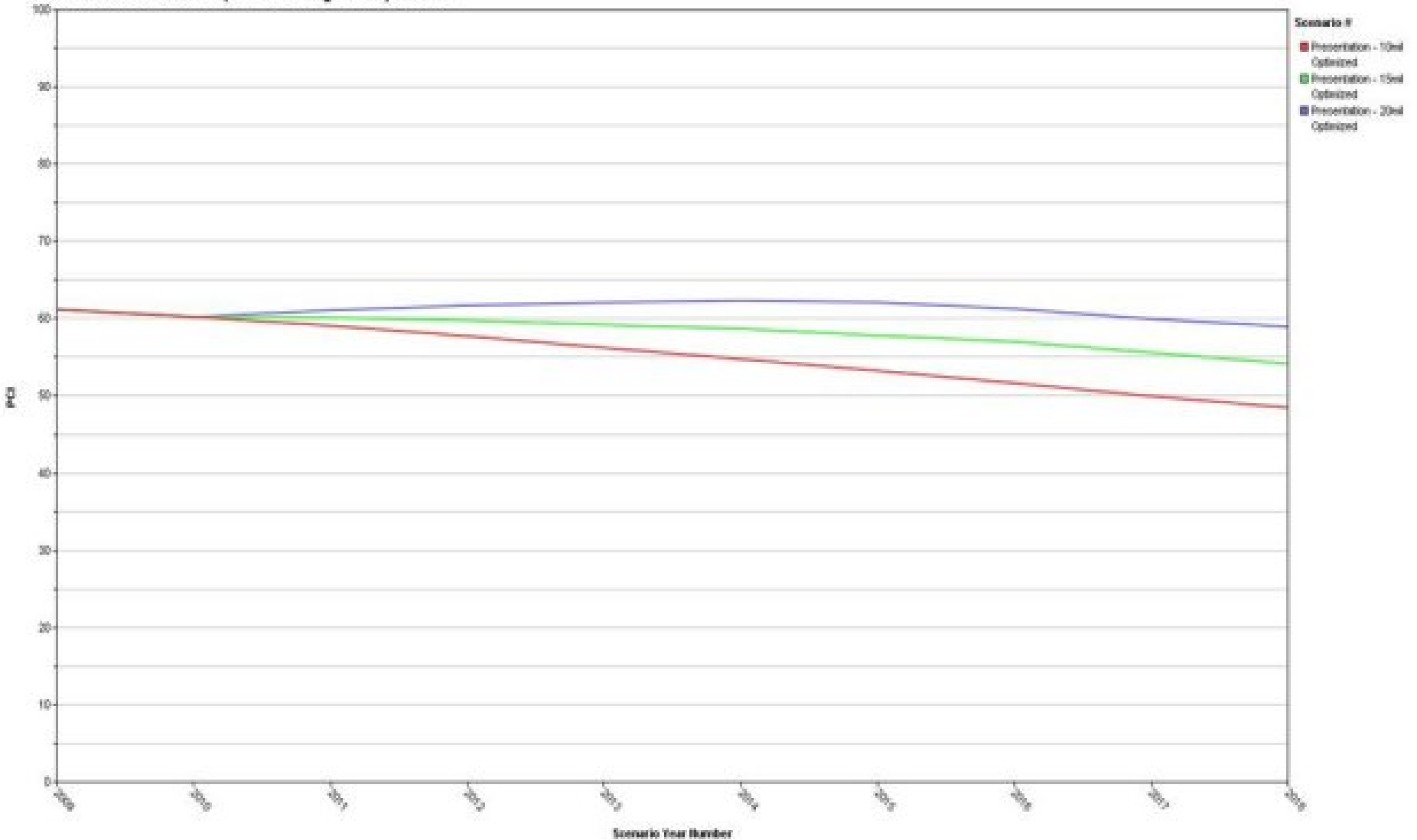
Worst-First Budgets

Network Condition - Worst First Budget Comparison



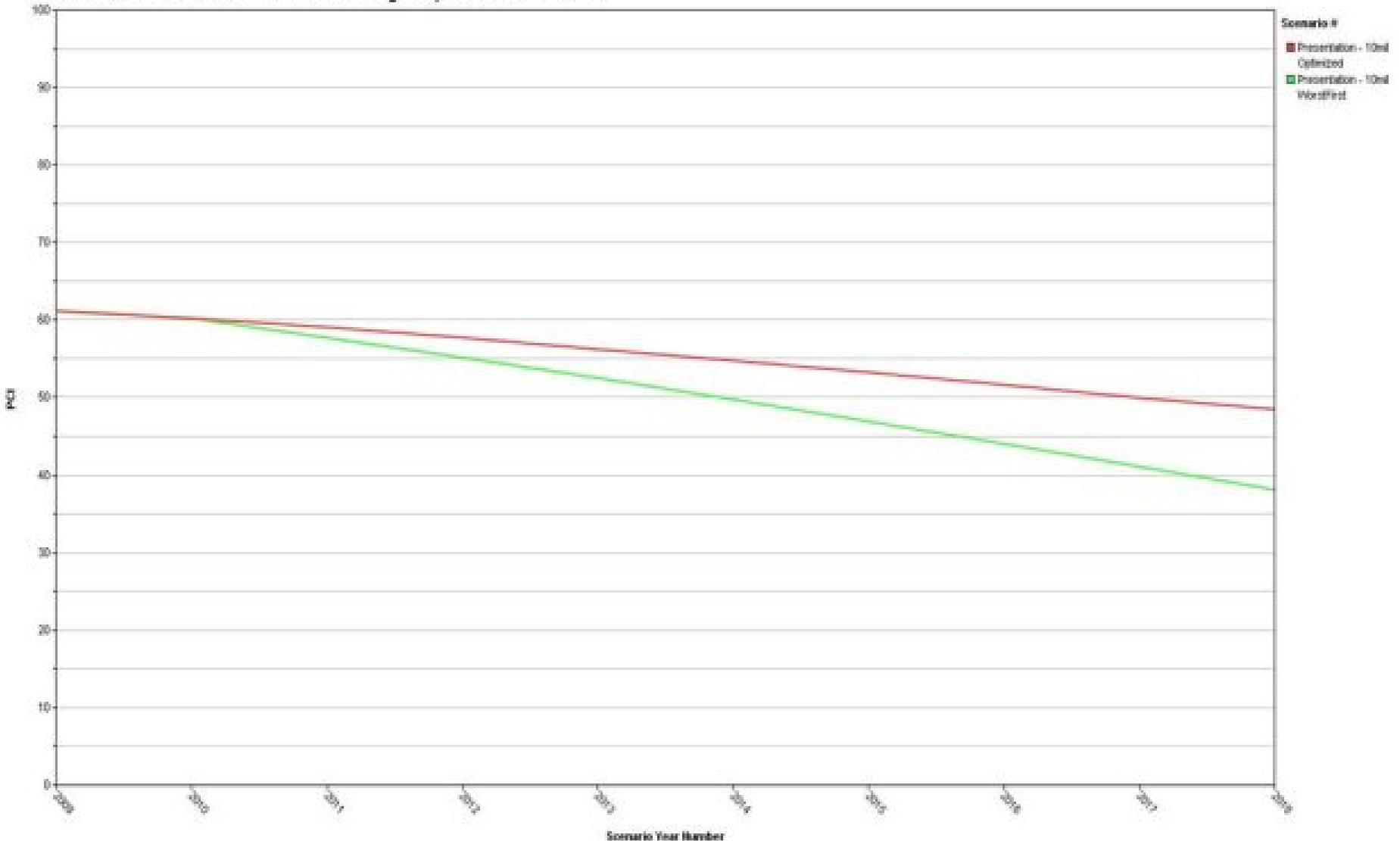
Optimized Budgets

Network Condition - Optimized Budget Comparisons

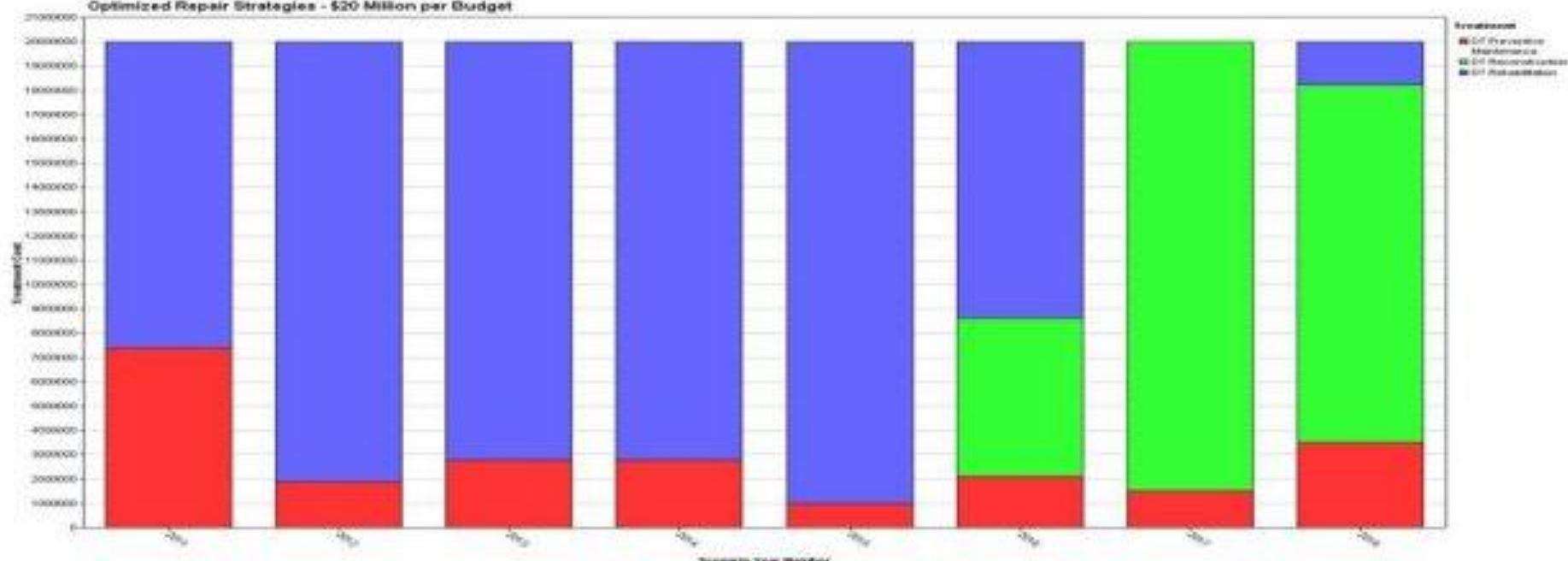


Worst-First vs. Optimized \$10 Mil./Yr.

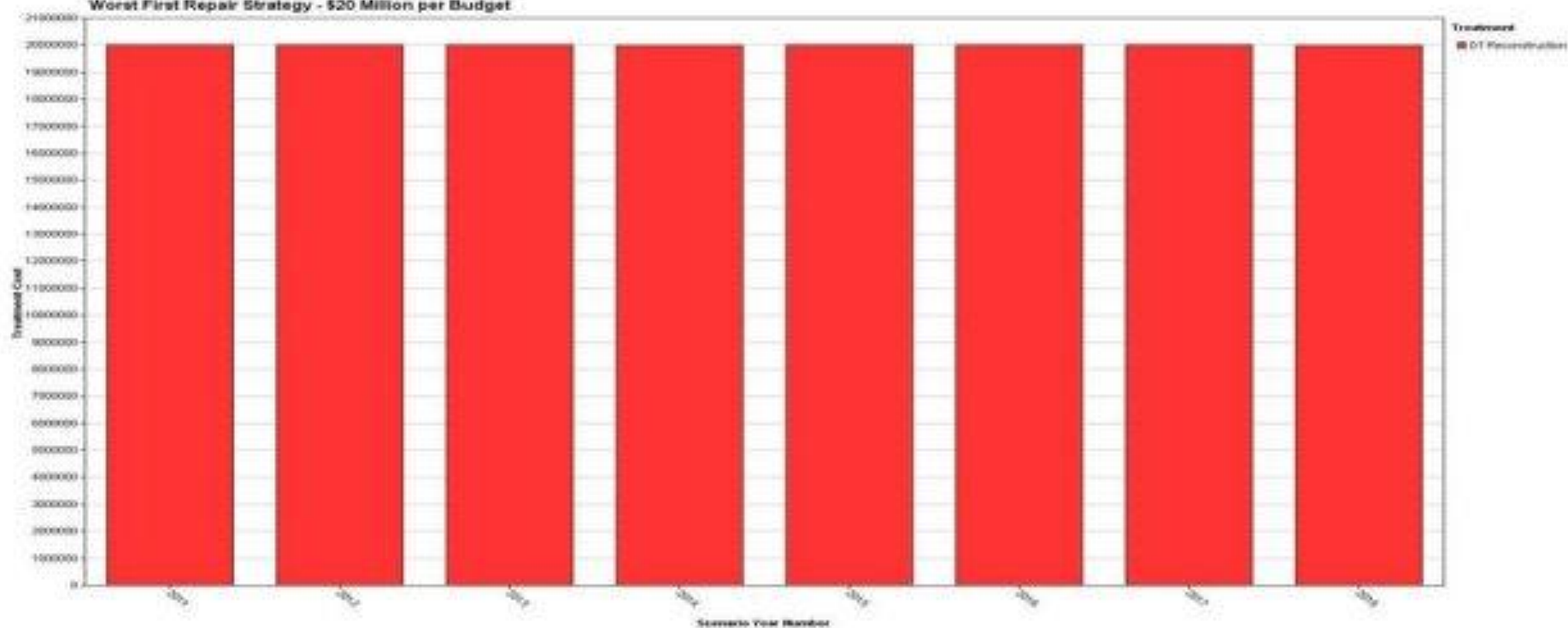
Network Condition - \$10 Million Per Year Budget - Optimized vs. Worst First



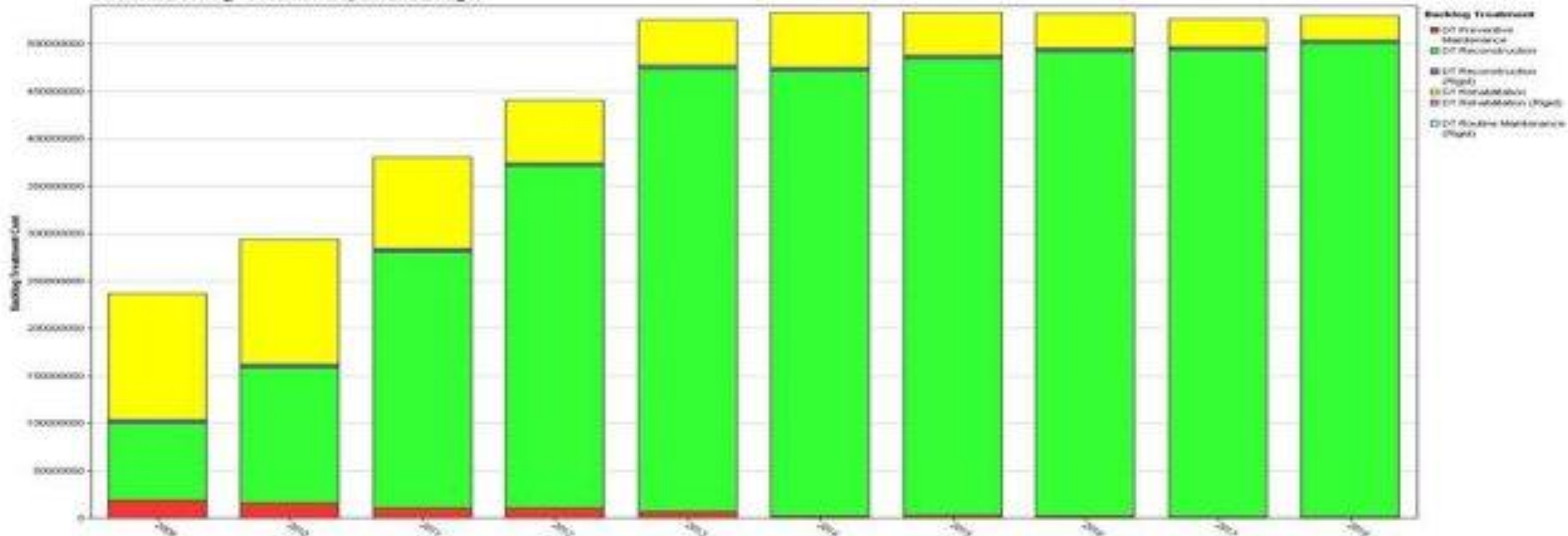
Optimized Repair Strategies - \$20 Million per Budget



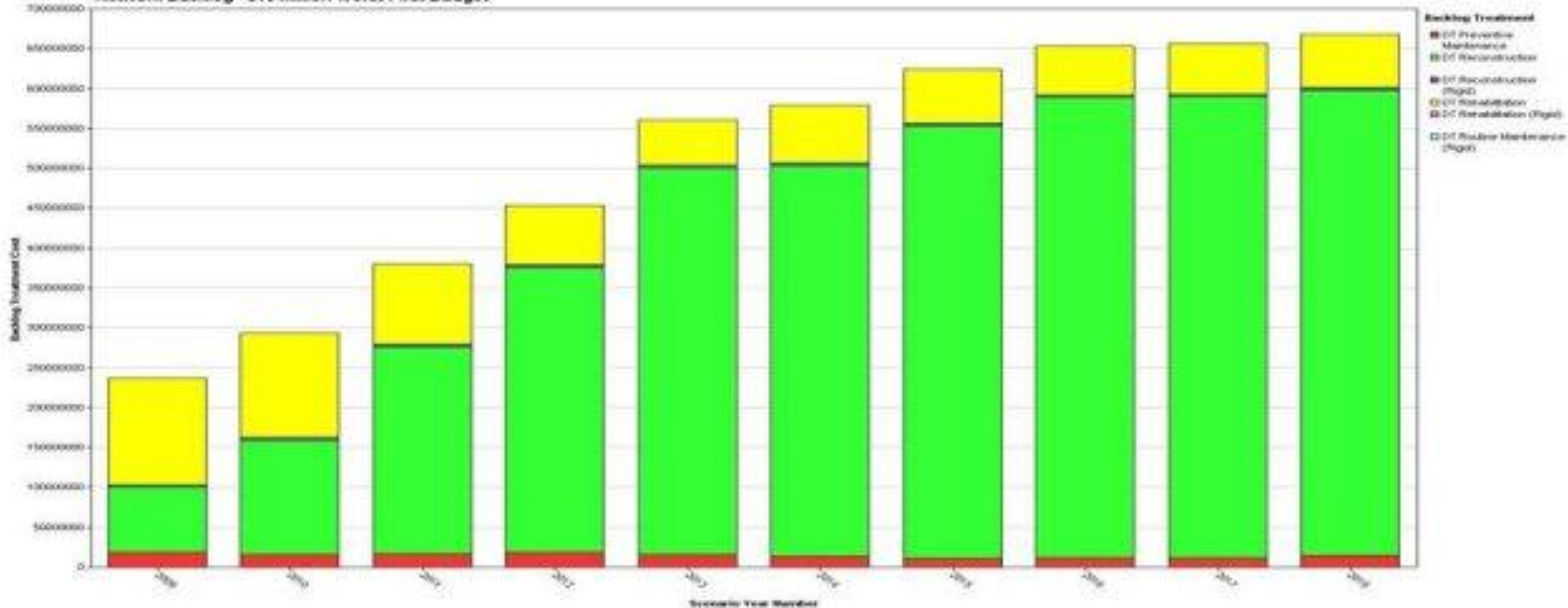
Worst First Repair Strategy - \$20 Million per Budget



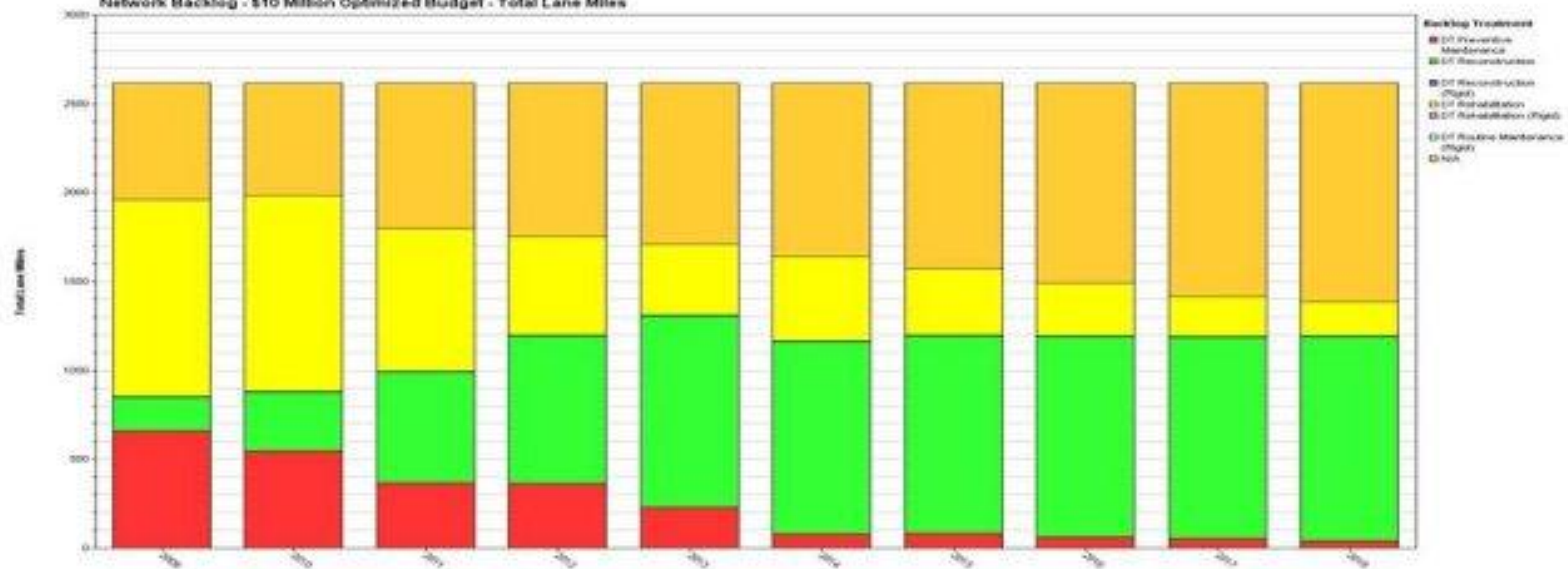
Network Backlog - \$10 Million Optimized Budget



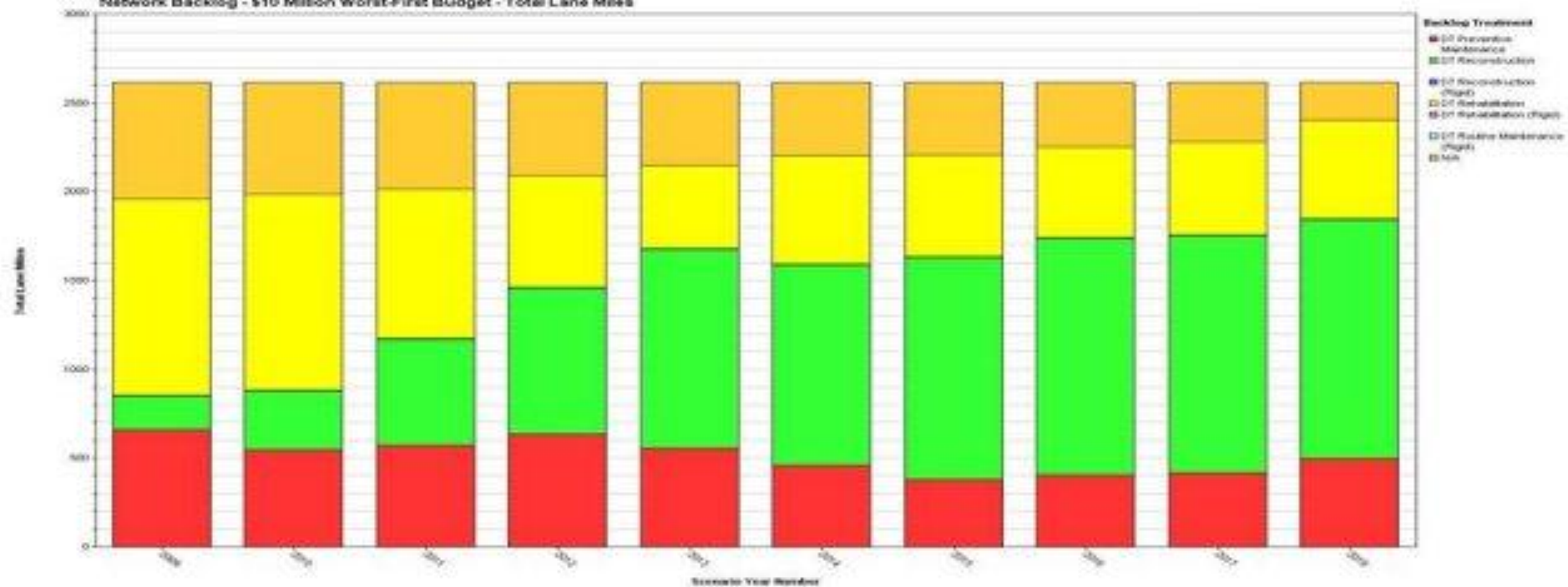
Network Backlog - \$10 Million Worst-First Budget



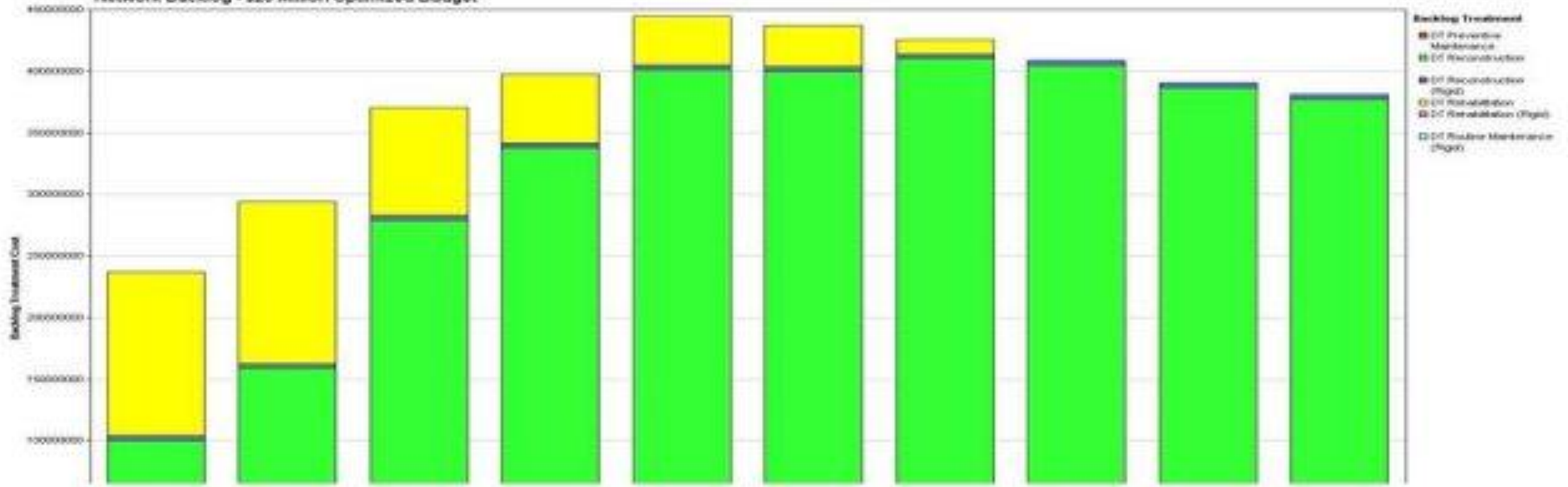
Network Backlog - \$10 Million Optimized Budget - Total Lane Miles



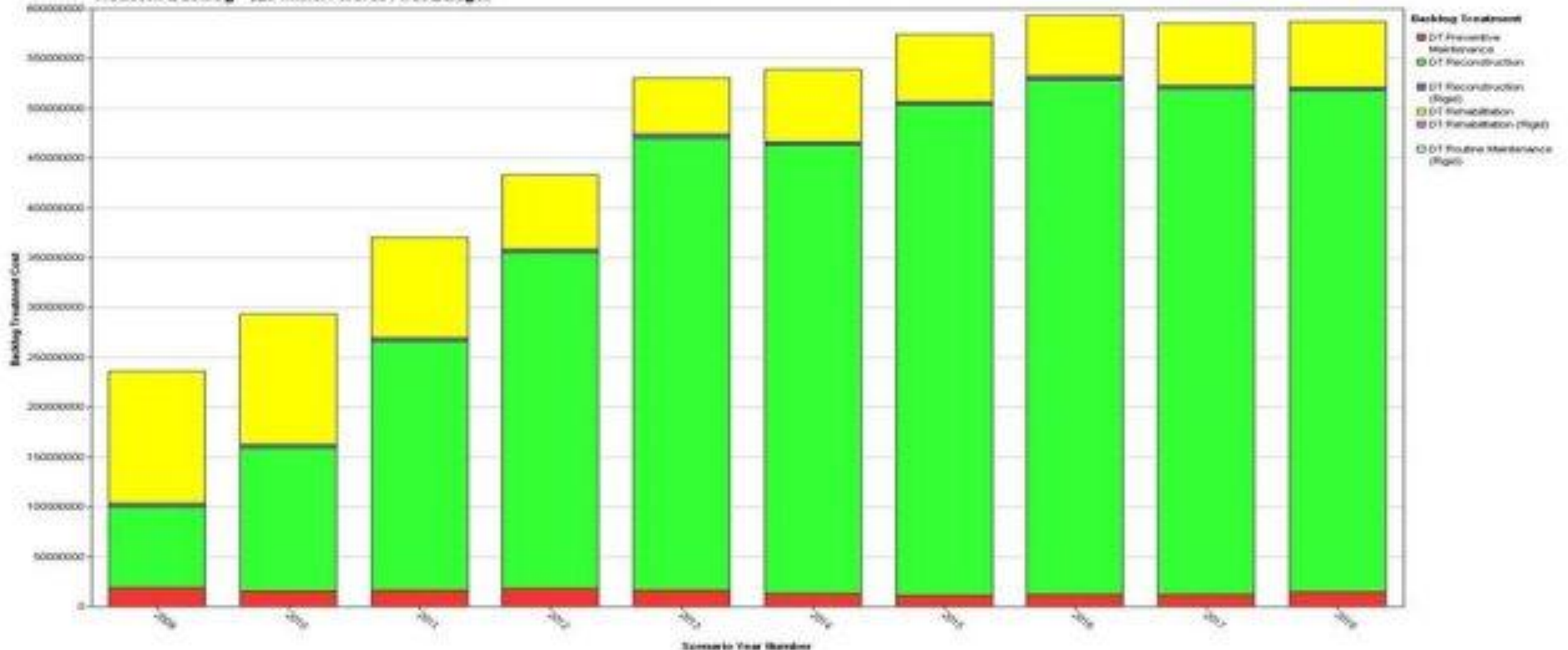
Network Backlog - \$10 Million Worst-First Budget - Total Lane Miles



Network Backlog - \$20 Million Optimized Budget



Network Backlog - \$20 Million Worst-First Budget



10 Yr. Comparison: Optimized vs. Worst-First

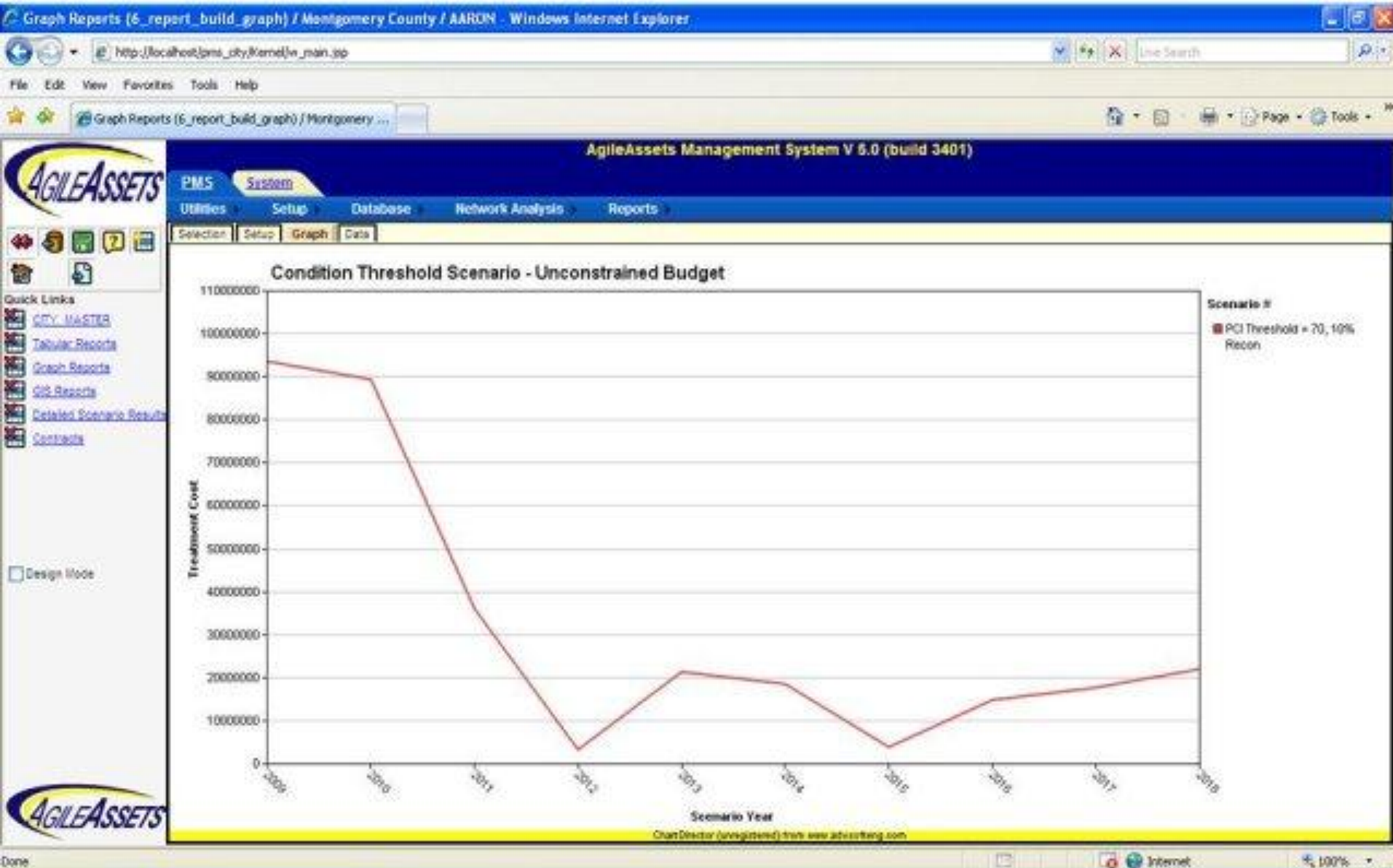
<u>Funding Level</u>	<u>Worst-First</u>	<u>Optimized</u>	<u>Decrease in Backlog</u>
\$10,000,000	\$680 Mil. PCI = 37	\$550 Mil PCI = 48	\$130 Mil.
\$15,000,000	\$630 Mil. PCI = 40	\$470 Mil PCI = 54	\$160 Mil.
\$20,000,000	\$570 Mil. PCI = 44	\$370 Mil PCI = 59	\$200 Mil.



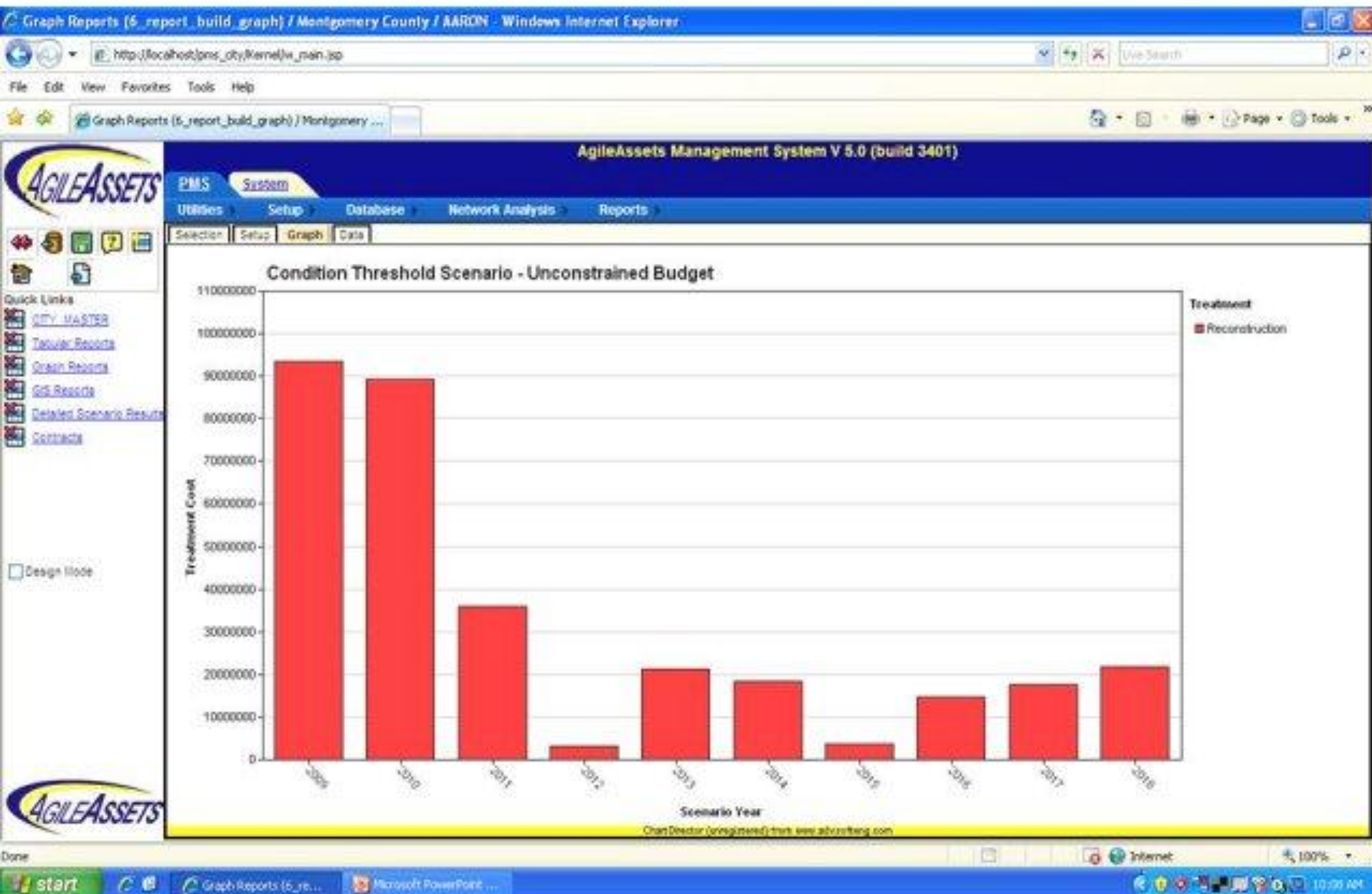
Multi-Constraint Analysis

Goal Setting

Condition Threshold PCI=70, Recon <10%



Condition Threshold PCI=70, Recon <10%



AgileAssets

Multi- Constraint Examples

Scenario No. 41 – PCI Threshold Varies to 70, Reconstruction Varies to 10%, Limiting Funds

<u>Year</u>	<u>Option 1</u>		<u>Option 2</u>	
	<u>Maximum % Reconstruction</u>	<u>Minimum PCI</u>	<u>Maximum % Reconstruction</u>	<u>Minimum PCI</u>
1	45	56	50	56
2	45	58	49	57
3	40	60	48	58
4	35	62	47	59
5	30	64	46	60
6	25	66	45	60
7	20	68	44	60
8	15	70	43	60
9	10	70	42	60
10	10	70	40	60

Multi-Constraint Analysis

Goal Setting



Condition Threshold PCI=70, Recon <10%, By Repair Category





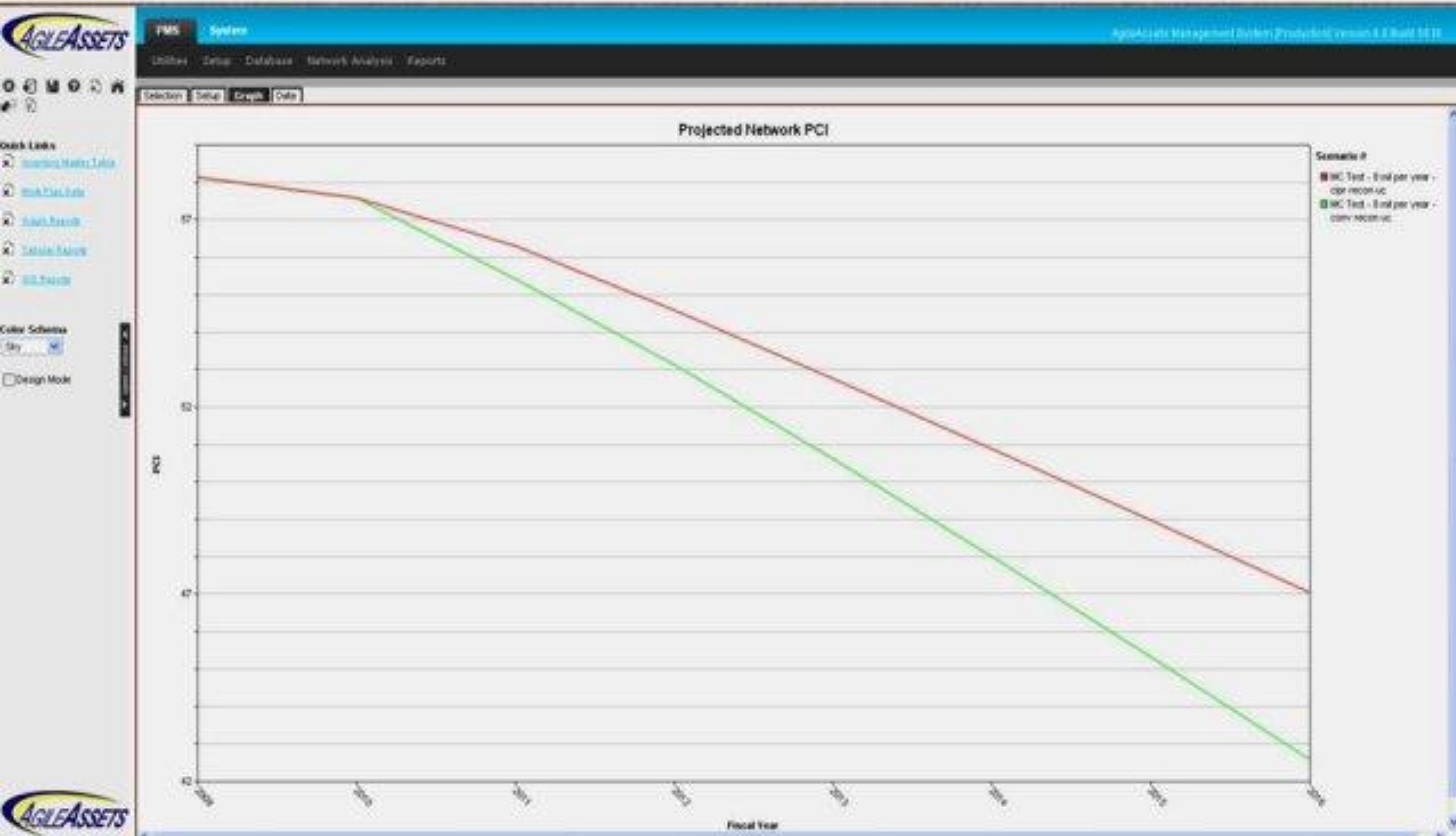
Backlog Analysis

Comparison of Different Repair Alternatives

CIR vs. Tradition Recon

Cold In-place Recycling vs. Traditional Reconstruction

\$8 Million Per Year



Cold In-place Recycling vs. Traditional Reconstruction

\$8 Million Per Year



Project Level Tools



Micro-Surfacing Project

- In 1995 – Pavement Management Analysis
 - Thin HMA w/ Little Base
 - Most Streets – M/H Severity Fatigue Cracking
 - Selected Repair – FDR w/ Cement

- Town-wide Waterline to be installed in 3 Years
 - Decided to Seal, Patch & Micro

2008

13-year old Sacrificial Layer











3 in. Binder/Micro on Gravel Road

Some Structural Cracking

No Environmental Cracking



Cold In-place Recycling

- Main road through an Industrial Park
 - Trash Transfer Station
 - More than 200 Trash Trucks/day - 6 days a week
 - 20 Trailers per day - 6 days a week
 - Concrete Plant
 - Crane Rental Business
 - Several Manufacturers
 - Many Warehouses



Cold In-place Recycling

- Pavement Cross-Section
 - 6 to 16 inches of Asphalt/Aggregate
 - “Evolutionary” Road (widened twice)
- Pavement Condition
 - Severe structural failure
 - Severe Cross-Slope and Profile Problems
- In 1994 - 5 inch CIR Base & 2 inch Overlay



Historical Data

- **Work Histories**
 - Track all Work Done to a Segment
 - Contract Based
 - Historical Repository – Attach Documents, Photos, etc.
 - Very Helpful for:
 - Design of Repairs
 - Development/Update of Performance Models
- **Pavement Layer Information**
 - Automatically Built by Entering Work Histories
- **Condition Histories**







Project Level

- **Work Histories**
 - Track all Work Done to a Segment
 - Contract Based
 - Historical Repository – Attach Documents, Photos, etc.
 - Very Helpful for:
 - Design of Repairs
 - Development/Update of Performance Models
- **Pavement Layer Information**
- **Condition Histories**



Research Tool

- Reviewing Performance data
 - What works vs. What doesn't
- Fine tuning decision models
 - Creating more classifications
 - thick vs. thin
 - w/ micro & w/o micro
 - w/ GABC vs. FDR vs. CIR
 - good vs. poor drainage

Work Histories

Contracts (6_contracts) / Montgomery County / AARON - Windows Internet Explorer

http://localhost/prs_city/Item/in_main.jsp

File Edit View Favorites Tools Help

Contracts (6_contracts) / Montgomery County / AARON

AgileAssets Management System V 6.0 (build 3401)

PMS System

Utilities Setup Database Network Analysis Reports

Contracts 1 pages (9 rows)

CONTRACT NAME	Project Location	Contractor	Typical Section	Year Completion	Treatment	Work Code	Att.	Comments	Last Updated by	Last Updated on
1984-01	Jones Bridge Rd-07-09	ABC Contractors		1994	Reconstruction	Construction			AARON	1/22/2009
1985-01	Jones Bridge Rd-01-05	Acme Construction		1995	Reconstruction	Construction			AARON	1/22/2009
1995-01	Jones Bridge Rd-01-02	Maryland Materials		1995	Rehabilitation	Rehabilitation			AARON	1/22/2009
1999-01	Jones Bridge Rd-10	ABC Contractors		1999	Reconstruction	Construction			AARON	1/23/2009
2002-01	Jones Bridge Rd-03-05	Acme Construction		2002	Rehabilitation	Rehabilitation			AARON	1/23/2009
1999-01	Jones Bridge Rd-05	Maryland Materials		1999	Rehabilitation	Rehabilitation			AARON	1/23/2009
2002-01	Jones Bridge Rd-05	ABC Contractors		2002	Rehabilitation	Rehabilitation			AARON	1/23/2009
2004-01	Jones Bridge Rd-07-08	Rockville Paving		2004	Preventive Maintenance	Preventive Maintenance			AARON	1/23/2009

Quick Links

- CITY MASTER
- Tabular Reports
- Graph Reports
- GIS Reports
- Related Spreadsheets
- Contracts

Design Mode

Sections 1 pages (3 rows)

Mgmt. Section #	Layers	Layers (Alt)	Att.	Comments	Last
48831	S	S	S	Jones Bridge	AAR
48822	S	S	S	Jones Bridge	AAR
48823	S	S	S	Jones Bridge	AAR

Tabular 1 pages (4 rows)

Layer	Material Code	Thickness	Comments	Att.	Last Upd
1	WC1	2			AARON
2	BC1	4			AARON
3	BCBC-1	6			AARON
4	GABC	10			AARON

Material Codes 3 pages (25 rows)

Material Code	Color	SB Coef.	Layer Category	Comments
New Material				
New Material				
New Material				
AC Surface				11
DGA / Gravel				31
Binder / Base				13
Treated Soil				34
0.75 Surface AJ				A1342
0.75 Surface AJ				A1362

Click here to begin

start Contracts (6_contra... Microsoft PowerPoint ...

Internet 100%

6:27 PM

Work Histories

Pavement Layer Info

Contracts (6_contracts) / Montgomery County / AARON - Windows Internet Explorer

http://localhost/pms_city/Kernel/w_main.jsp

AgileAssets Management System V 5.0 (build 3401)

PMS System

Utilities Setup Database Network Analysis Reports

Contracts (6_contracts) / Montgomery County / AARON

AGILEASSETS

Quick Links

- CITY MASTER
- Tabular Reports
- Graph Reports
- GIS Reports
- Detailed Scenario Results
- Contracts

Design Mode

AGILEASSETS

Contract	Year	Project Location	Contractor	Typical Section	Year Completion	Treatment	Work Code	Am.	Comments	Last Updated by	Last Updated on
1994-01	1994	Jones Bridge								AARON	1/22/2009
1995-01	1995	Jones Bridge								AARON	1/22/2009
1996-01	1996	Jones Bridge								AARON	1/22/2009
1999-01	1999	Jones Bridge								AARON	1/23/2009
2002-01	2002	Jones Bridge								AARON	1/23/2009
1999-01	1999	Jones Bridge								AARON	1/23/2009
2003-01	2003	Jones Bridge								AARON	1/23/2009
2004-01	2004	Jones Bridge								AARON	1/23/2009
2004-02	2004	Jones Bridge								AARON	1/23/2009

Construction Graph (construction_graph_by_section)

Contract: 1994-01
Year: 1994
Work Code: Construction
Work Type: C
Material: BCI
Thickness: 4

Color	SN Coef.	Layer Category	Comments
			11
			31
			13
			54
			A-1342
			A-1382

3 pages (25 rows)

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Work Histories Attachments

Contracts (6_contracts) / Montgomery County / AARON - Windows Internet Explorer

http://localhost/pms_city/Kernel/v_main.jsp

File Edit View Favorites Tools Help

Contracts (6_contracts) / Montgomery County / AARON

AgileAssets Management System V 5.0 (build 3401)

PMS System

Utilities Setup Database Network Analysis Reports


Contracts

1 pages (9 rows)

CONTRACT NAME	Project Location	Contractor	Typical Section	Year Completion	Treatment	Work Code	Att.	Comments	Last Updated by	Last Updated on
1994-01	Jones Bridge Rd-07-05	ABC Contractors		1994	Reconstruction	Construction			AARON	1/23/2009
1995-01	Jones Bridge Rd-01-06	Acme Construction		1995	Reconstruction	Construction			AARON	1/23/2009
1996-01	Jones Bridge Rd-01-02				Rehabilitation	Rehabilitation			AARON	1/23/2009
1996-01	Jones Bridge Rd-10				Construction	Construction			AARON	1/23/2009
2002-01	Jones Bridge Rd-03-05				Rehabilitation	Rehabilitation			AARON	1/23/2009
1995-01	Jones Bridge Rd-06				Rehabilitation	Rehabilitation			AARON	1/23/2009
2003-01	Jones Bridge Rd-01-02				Rehabilitation	Rehabilitation			AARON	1/23/2009
2004-01	Jones Bridge Rd-06				Rehabilitation	Rehabilitation			AARON	1/23/2009
2004-02	Jones Bridge Rd-07-05				Preventive Maintenance	Preventive Maintenance			AARON	1/23/2009

Work With Attachments (open comments)

401044 Superpave Pg 04-22.doc



Change order... Add...

Material Codes

Att.	Comments	Att.	Last Upd	Material Code	Color	SN Coef.	Layer Category	Comments
2		AARON		New Material				
4		AARON		New Material				
6		AARON		New Material				
10		AARON		AC Surface				11
				DGA / Gravel				31
				Binder / Base				13
				Treated Soil				34
				8.38 Surface AJ				A1342
				8.38 Surface AJ				A1382

Done

start

Contracts (6_contrac...)

Microsoft PowerPoint ...

Internet

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Work Histories Attachments

Contracts (6_contracts) / Montgomery County / AARON - Windows Internet Explorer

http://localhost/pms_city/Kernel/v_main.jsp

File Edit View Favorites Tools Help

Contracts (6_contracts) / Montgomery County / AARON

AgileAssets Management System V 5.0 (build 3401)

PMS System

Utilities Setup Database Network Analysis Reports

Contracts

1 pages (9 rows)

CONTRACT NAME	Project Location	Contractor	Typical Section	Year Completion	Treatment	Work Code	Att.	Comments	Last Updated by	Last Updated on
1994-01	Jones Bridge Rd-01-05	ABC Contractors		1994	Reconstruction	Construct			AARON	1/23/2009
1998-01	Jones Bridge Rd-01-05	Acme Construction		1998	Reconstruction	Construct			AARON	1/23/2009
1999-01				1999	Rehabilitation	Rehabilitation			AARON	1/23/2009
1999-01				1999	Reconstruction	Construct			AARON	1/23/2009
2002-01				2002	Rehabilitation	Rehabilitation			AARON	1/23/2009
2002-01				2002	Rehabilitation	Rehabilitation			AARON	1/23/2009
2003-01				2003	Rehabilitation	Rehabilitation			AARON	1/23/2009
2003-01				2003	Rehabilitation	Rehabilitation			AARON	1/23/2009
2004-01				2004	Rehabilitation	Rehabilitation			AARON	1/23/2009
2004-01				2004	Preventive Maintenance	Preventive Maintenance			AARON	1/23/2009

Work With Attachments (open_comments)

Change order... Add...

Section

Mgmt.

asphalt

1 pages (4 rows)

Layer	Material Code	Thickness	Comments	Att.	Last Upd
1	WC1	2		AARON	
2	BC1	4		AARON	
3	BCBC-1	6		AARON	
4	OABC	10		AARON	

Material Codes

3 pages (25 rows)

Material Code	Color	SN Coef.	Layer Category	Comments
New Material				
New Material				
New Material 2				
AC Surface				11
DGA / Gravel				31
Binder / Base				13
Treated Soil				34
8.38 Surface AJ				A1342
8.38 Surface AJ				A1382

Done

start

Contracts (6_contra...)

Microsoft PowerPoint ...

101644_Superpave...

Internet

100%

6:31 PM

Work Histories Attachments

The screenshot displays a web browser window with the URL `http://localhost/pms_city/Kernel/vt_main.jsp`. The application interface includes a sidebar with 'AGILEASSETS' branding and a 'Quick Links' menu. The main content area features a 'Contracts' table with columns for 'CONTRACT NAME', 'Project Location', and 'Contract'. A 'Work With Attachments' button is visible below the table. An attached Microsoft Word document is open, showing technical specifications for 'PG-64-22, PATCHING' and 'SUPERPAVE, TYPE C HOT-MIX, 160 GIRATIONS, PG-64-22, WEDGE'. The document includes sections for 'Description', 'Materials', and 'Special Provisions'.

CONTRACT NAME	Project Location	Contract
1994-01	Jones Bridge Rd-01-05	ABC Con
1995-01	Jones Bridge Rd-01-05	Acme Co
1996-01		
1997-01		
1998-01		
1999-01		
2000-01		
2001-01		
2002-01		
2003-01		
2004-01		
2004-01		

AGILEASSETS

Quick Links

- CITY MASTER
- Tabular Reports
- Graph Reports
- GIS Reports
- Detailed Scenario Results
- Contracts

Design Mode

AGILEASSETS

Microsoft Word: 401644_Superpave Pg_64 22(1)

PG-64-22, PATCHING

401648 - SUPERPAVE, TYPE C HOT-MIX, 160 GIRATIONS, PG-64-22, WEDGE

401649 - SUPERPAVE, TYPE B HOT-MIX, 160 GIRATIONS, PG-64-22, WEDGE

Description:

The following Subsections of the Standard Specifications shall be applicable: 401.11, 401.13, 401.13, 401.12, and 401.13. All other subsections have been modified herein.

The Contractor shall read and thoroughly understand the requirements of the QA/QC specifications as defined in item 401699. It is the responsibility of the Contractor to determine all costs associated with meeting these requirements and to include them in the per ton bid for the

SPECIAL PROVISIONS SP-3

Materials:

Material for hot-mix, hot-laid bituminous concrete shall conform to the requirements of Subsections 803.01, 803.04, 803.07, and 803.08, 803.09 of the Standard Specifications and the

Condition History

	<u>Segment No.</u>									
<u>Year</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
1988	Recon									
1994							Recon			
1996	Rehab (8)									
1998							Rehab (10)			
1999										Recon-FDR (5)
2002				Rehab (14)						
2003	Rehab (7)									
2004							Rehab (6)			
2004							Surf Treat (10)			

Current PCI	55	50	82	78	84	68	93	91	51	76
Years since Treat	5	5	6	6	6	4	4	4	14	9
Current Treatment	Rehab	Rehab	Routine	Surf	Routine	Surf	None	None	Rehab	Surf
Possible Issue	✓	✓	?	?	?	✓				



Montgomery County Pavement Management System

Questions?